



## MULTI-YEAR PROCUREMENT A "TEAM APPROACH"

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### ABSTRACT

Although the multi-year concept has been on the scene for many years, the associated regulations (e.g. DAR 1-322) had severely limited its application to major acquisition programs. The prominence of Multi-Year Procurement in the Department of Defense Acquisition Improvement Program of 1981 (Initiative #3), coupled with the alterations included in the fiscal 1982 Defense Authorization Act, signaled a serious attempt by the government to make Multi-Year Procurement a viable acquisition strategy for major defense procurements.

The specific example of the Navy C-2A Aircraft Reprourement demonstrates that the successful application of multi-year to major systems acquisitions requires a team effort by government, the prime contractor and his subcontractors. Since Multi-Year Procurement essentially represents an investment decision on the part of the government, it became apparent that the relative "goodness" of the multi-year proposition, would be founded on the most judicious application of the "expanded advance procurement" funding made available to the prime contractor by the government and by the development of additional sources of savings such as: capital equipment investment, to improve producibility, risk assumption by the prime contractor, risk assumption by the subcontractors, make/buy decisions and increased competition.

In the case of the Reproced C-2A, the aggressive application of the above policies has increased the initial program savings estimates by a factor of over 50% (program savings of \$58M have grown to \$89M). Multi-Year Procurement, the 1980 version, is providing all the benefits of a bigger bang for the defense dollar while improving the defense industrial base, filling idle capacity and putting people back to work.

### INTRODUCTION

This paper will provide insight into the lessons learned during the conduct of the first two years of the Reproced C-2A Program, the Navy's first major multi-year aircraft acquisition. The "team attitude" which developed between all the players: Congress, OSD, Navy, Grumman and Grumman's suppliers will be emphasized. Data will be presented which will demonstrate the value of Multi-Year Procurement in today's economy. A classical mathematical approach will be offered, for use by multi-year planners when considering alternatives leading

to the optimization of a given multi-year program. In addition, specific C-2A data will be provided to show the actual results when the optimization techniques are aggressively applied and when the subcontractor organizations are fully informed and motivated to participate in a multi-year program that is beneficial to all participants.

Inherent in this paper is the assumption that a program cannot be designated a multi-year candidate unless it fully conforms to the "footprint" stipulated in Public Law 97-86. These criteria are fundamental to the basic concept of Multi-Year Procurement and include:

- That the minimum need will remain in effect during the course of the contract.
- That there is a reasonable expectation that DOD will continue to sequentially fund the program.
- That the program will promote the national security while reducing total cost.
- That the cost estimates are realistic (annual and multi-year).
- That there is a stable design.

The final item, design stability, is probably the most difficult to judge and the one most likely to create havoc with a multi-year plan. It shall be assumed for the context of this paper that some very rigorous configuration control rules have been agreed upon, between the government and the prime contractor, and that an "environment for no change" has been created on the program. This can be accomplished by:

- Preparing an extremely detailed analysis of the requirement before the design specification is finalized with the government and translating that detail into the subcontractor specifications.
- Staying away from items of an R&D nature. (Utilize field proven off-the-shelf hardware and software.)
- Avoiding complex packaging techniques that require latest state of the art semiconductors or that require special cooling techniques.
- Eliminating items that require RDT&E and steering clear of concurrency.
- Avoiding technologies that become obsolete quickly.

Having carefully selected our multi-year candidates to the aforementioned criteria, we are now ready to discuss the techniques that can be utilized to optimize and enhance a multi-year from the standpoint of an investment decision.

### THE NEW SYNERGISM IN DEFENSE ACQUISITION

Achievement of the goals of the DOD Acquisition Improvement Program requires a coordinated effort by DOD, the Congress and industry. Perhaps the best example of the new synergism fostered by these initiatives is represented in the application of the multi-year concept to major defense acquisitions. The Congress led the way by encouraging the judicious use of multi-year acquisition and by clearing the legal roadblocks to its implementation; specifically by allowing for an expanded advanced procurement cancellation ceiling (\$100M vice \$5M without Congressional approval), and by permitting the use of unfunded ceilings for recurring costs as well as nonrecurring costs. Contracting authorities have moved to bring contracts into conformance with the new laws by:

(a) Eliminating the mandatory level pricing requirements stipulated in DAR 1-322.

(b) Providing provisions for expeditious progress payments when contractors demonstrate that multi-year advanced procurement creates additional inventory carrying costs.

(c) Allowing indemnification (cancellation ceiling coverage) for capital equipment investments that generate savings to the government, in accordance with DAR 3-815, along with added profit potential for contractors and subcontractors that take risks to develop savings through improved productivity.

Industry has replied in kind with a willingness to invest in some badly needed capital equipment improvements, to spend the non-recurring to develop the required rate tooling, and to absorb some of the termination liability necessary to make Multi-Year Procurement attractive from a cost savings/up-front investment standpoint.

### THE MULTI-YEAR GAME PLAN

The "bedrock" of all multi-year efforts are the scenarios picked early in the game for the procurement of material and equipment (subcontractors) and for the manufacture of parts and sub-assemblies within the prime contractor's facilities. These two scenarios determine the eventual success of the multi-year. Therefore, extra time and effort should be expended performing a full and complete analysis prior to firming up the final scenarios. A typical procurement scenario for an aircraft program is presented in Figure 1. Key factors that must be evaluated in determining the final scenario are: design

stability of each subsystem (note that the power supply and weapons delivery systems are not aggressively multi-year procured in our sample because they have a history of configuration instability), subcontractor capacity (note that the APU and engines are not being aggressively multi-year in our example because the supplier has reached his plant limits for all the engines he delivers) shelf life of the equipment, storage availability and the amount of up front termination liability required to advance procure the material. Given the complexity of the equipment and the multiplicity of the factors involved, determining an optimum procurement scenario will require a series of iterations and an extensive amount of information exchange with the suppliers. However, it should be noted at this point that substantial flexibility exists at the prime contractor level to select the components to be aggressively multi-year so that the Congressional footprint for multi-year candidates is not violated and the risk of change is greatly reduced.

**TYPICAL MULTI-YEAR SUBCONTRACTOR PROCUREMENT SCENARIO FOR AN AIRCRAFT PROGRAM**

ITEM	QUANTITIES					TOTAL SHOP DTS	% OF TOTAL COST
	Y1	Y2	Y3	Y4	Y5		
RAW MATL	400	-	-	-	-	400	2
CANNONS	500	500	-	-	-	1000	5
FORGEING	200	200	-	-	-	400	4
ELECTRICAL	300	100	-	-	-	400	3
HYDRAULICS	200	200	-	-	-	400	3
ANTENNAS & UNIVERSAL	400	-	-	-	-	400	4
ENVIRONMENTAL SYSTEM	200	100	100	-	-	400	7
FUEL SYSTEM	100	100	100	100	-	400	3
LANDING GEAR	200	100	100	-	-	400	10
INSTRUMENTS	200	200	-	-	-	400	2
MACHINED PARTS	100	100	100	100	-	400	10
COCKPIT SYSTEM	100	-	-	-	-	100	2
NAV SYSTEM	400	-	-	-	-	400	2
WEAPONS DELIVERY	50	50	50	50	50	250	15
POWER SUPPLY	50	50	50	50	50	250	2
FLIGHT CONTROLS	400	-	-	-	-	400	2
SEATS	400	-	-	-	-	400	1
CANOPY	400	-	-	-	-	400	2
APU & ENGINES	100	100	100	100	-	400	20

Figure 1

Step II of the scenario generation process is the selection of a manufacturing plan that is achievable, fits well with the rest of the work being performed within the shop and provides the savings desired. Figure 2 represents a typical example of a multi-year manufacturing scenario for an aircraft program. Key factors that determine the individual elements of this scenario are: non-recurring required to achieve the increased rates, manpower loading in the shop, machine capacity, storage life, storage availability and the amount of up front cash flow required to support the advance manufacture of equipment. Most multi-year practitioners have found it advantageous to schedule their multi-year build cycles around the other efforts within the shop, thereby, increasing the efficiency of the entire shop, while maintaining employment levels, thus improving the profit achieved across the board. The flex-

ibility of the multi-year advance manufacturing plan clearly has beneficial effects on the entire shop when care is taken to schedule the multi-year release plan to "level load" the shop's efforts.

#### TYPICAL MULTI-YEAR MANUFACTURING SCENARIO FOR AN AIRCRAFT PROGRAM

ITEMS	Yr 1	Yr 2	Yr 3	Yr 4	Yr 5	TOTAL SHOP SETS
DETAIL PARTS	200	100	100	-	-	400
MINOR SUBS	200	100	100	00	-	400
MAJOR SUBS	00	00	00	00	00	400
PRINL ASBY	00	00	00	00	00	400

Figure 2

#### 14E UP FRONT FUNDING/SAVINGS DILEMMA

Since multi-year savings are directly dependent on the number and kind of front end commitments made, it became obvious that success would be a function of the judicious application of the additional advance procurement funding provided by Congress, as well as the added "leverage" that could be generated thru the assumption of risk by contractors and sub-contractors. Contractor and sub-contractor risk assumption, known as the "stretch" factor, has become increasingly critical as a result of the DOD multi-year policy of funding to the termination liability level and the Congressional desire to limit the funding provided in the initial years of the multi-year profile. The following equations represent in mathematical form the management problem facing a multi-year planner:

- (1) Multi-Year Savings ~ Up Front Economic Order Quantities

- (2) Total Termination Liability (TTL) = Long Lead Termination Liability (LLTL)

(to protect schedule)

+ Economic Ordering Quantity Termination Liability (EOQTL)

(to generate savings)

- (3) Savings Leverage = Expanded Advanced Procurement Funding Provided by the Government

"Stretch Factor" { + Contractor absorbed EOQ T.L.  
+ Sub-Contractor absorbed EOQ T.L.

Creative application of the limited amount of government provided funding as well as a program to encourage self commitments within industry is the foundation of the challenge in optimizing a given multi-year program. In planning and implementing the Reprocured C-2A, Grumman and the Navy have recognized the importance of these factors by designating termination liability as the "perishable commodity" and competing all sub-contractors against each other for the privilege of receiving an aggressive multi-year sub-contract. Once again, a formula was developed to assure maximization of savings utilizing the limited budget. As shown below, each sub-contractor's multi-year proposal was measured from the standpoint of savings offered (the good news) and the additional termination liability (the bad news) needed in the initial fiscal years.

Figure of Merit =  $fm = \Delta$  Savings

$\Delta$  Termination Liability

Those sub-contractors responding with proposals where extra savings were derived as a result of capital equipment investments or as a result of absorption of risk were rewarded with more aggressive multi-year sub-contracts (additional profit collection in the early years) and an increase in profit percentage. An interesting example of the results generated by this type of an effort is shown in Figure 3. Note that the supplier has provided a proposal that offers almost \$1M in savings (25%) but has actually reduced his request for termination liability and cash flow in the first year of the contract.

#### MULTI-YEAR VS ANNUAL BUY TYPICAL ENGINE ASSEMBLY

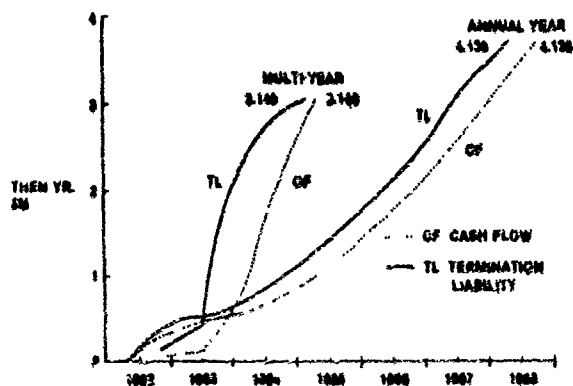


Figure 3

Since we know that he is pursuing an aggressive multi-year policy, we have to assume that his actual multi-year bills and commitments will far exceed the annual year quantities in that

time period. However, he has decided to absorb some of the risk in the early stages in return for a shortened period of performance (3 years versus 6) and additional profit recognition in his fixed price contract. This supplier's Figure of Merit would, obviously, place him high on the list for receiving the most aggressive multi-year contract possible.

#### SAVINGS CREDIBILITY AND THE INVESTMENT ANALYSIS

Incumbent in the preparation of any multi-year proposal is the development of a cost estimate based on the standard annual year approach. Since a contract will be signed for the multi-year value, the credibility of the savings will be specifically dependent on the veracity of the annual year number. Therefore, it is extremely important that a procedure be developed for calculating and verifying the annual year estimate. To successfully accomplish this on the C-2A Program, it was agreed at an early date to require two fully auditable cost proposals. A single year firm proposal on an annual year basis plus an estimate for four additional years on a budgetary basis made up the five year annual estimate. This was compared with the five year multi-year proposal to determine savings. Figure 4 represents the logic process flow utilized to develop savings credibility for the C-2A. Note that, although the annual year contract was not negotiated, a negotiation decrement similar to the multi-year negotiation result was taken. Another key factor was the selection of an escalation index that would best represent the average inflation rate over the extended period of performance.

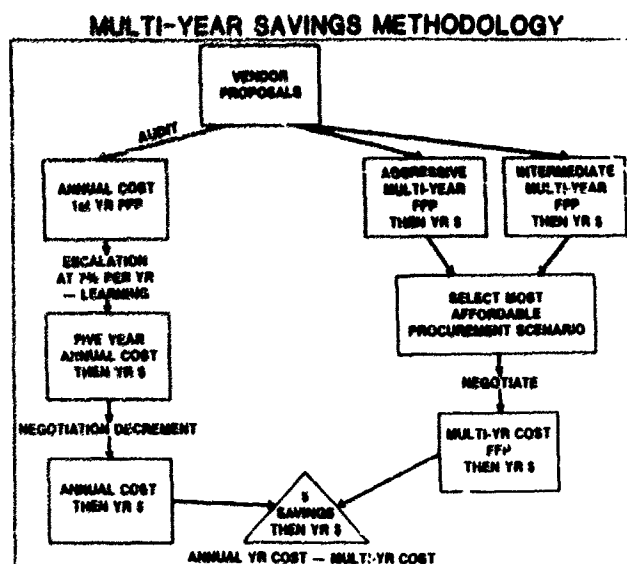


Figure 4

For the C-2A example, Grumman and the Navy selected 7% as a reasonably conservative guess. Savings were then calculated on a then year dollar basis with the percentage saved being determined by dividing the dollar savings to the annual year contract value.

Since the basis of the Congressional and DOD action was to obtain increasing numbers of defense products for less money by investing more money up front, a requirement was generated to justify each multi-year on the basis of a "real" value of money financial analysis. To accomplish this, the government turned to the Discounted Cash Flow techniques developed by the academic community. This technique was evolved to provide a means for business people to make investment judgements during periods of high inflation and high interest rates. In the business world this analysis approach provides comparative assessments for varying propositions by measuring the investment costs (including loss of opportunity) against the time value of the profits they generate. By discounting the values of the cash flows back to the initial date, monetary values can be added and subtracted arithmetically and a resultant Net Present Value can be determined. For a multi-year analysis, the outlays for each fiscal year would be determined for the annual and multi-year programs, subtracted on yearly basis, and the resultant cash flows discounted to year one and added to determine the net present value. In all cases, multi-year will cause increased outlays up front and decreased outlays in the latter years. Thus, the determining factors in the relative "goodness" of the multi-year will be the limiting of additional expenditures early in the game, while at the same time generating the maximum savings at the earliest point in the program. Inherent in this analysis is the necessity to select a discount rate (expected average interest rate). At the present time, OMB and DOD guidance requires that a discount rate of 10% be employed when calculating the net present value. Obviously, the higher the net present value the more likely the multi-year program will be approved by the government.

#### INITIAL RESULTS FOR THE REPROCURED C-2A

In October of 1981, Grumman Aerospace submitted its initial Multi-Year Proposal to the Navy for 39 Reprocured C-2As to be delivered over a five year period. Multi-Year savings, at that point, were estimated at \$58M or just under 8% of the total contract cost. This estimate was founded solely on budgetary proposals submitted from the major suppliers. On December 3, 1981, Grumman and the Navy held a multi-year get acquainted session for approximately 50 sub-contractors, representing

85% of the procurement cost for the C-2A. In this session, the multi-year concept was presented from the standpoint of the benefits that would be accrued to each sub-contractor and incentives were offered to those that were willing to aggressively participate. Everyone was told that they were competing against each other for the limited amount of available termination liability and that the suppliers desiring additional profit and shorter performance periods would have to improve their proposals to create an attractive Figure of Merit (fm). The response was dramatic and fortuitous, as can be seen in Figure 5. Multi-Year savings continued to grow and reached \$89M (11.6% of contract cost) at the time of the formal contract signing between Grumman and the Navy. The suspected causes for the increase are also listed in Figure 5 and those which have not yet been discussed merit some attention.

#### REPROCURED C-2A MULTI-YEAR SAVINGS ESTIMATE, HISTOGRAM

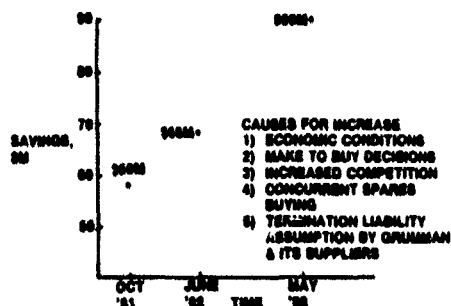


Figure 5

The economic environment in the United States during the period of time depicted was recessionary, thereby leading to a situation where most manufacturing facilities were substantially under capacity with a work force that was under-utilized. Thus, multi-year offerings were seen as an opportunity to fill idle capacity, improve the efficiency of the workforce and provide the business base needed to upgrade the capital equipment. Once the education process had been completed, many suppliers saw multi-year as the opportunity of a lifetime and were willing to take on risks or bid at lower profit levels, safe in the knowledge that additional profits would be generated on other efforts as a result of the manufacturing efficiencies created by the flexibility of the multi-year work. This situation was further enhanced by the concurrent ordering of the initial spares increment with the aircraft orders. Increased quantities were generated, resulting in a 25% savings on the spares buy and additional reductions on the unit cost of the aircraft buy. In combination, the cooperative effort by Grumman and the Navy, produced a subcontractor response that

far exceeded all expectations. The data shown in Figure 6 represents the subcontractor results to date and indicates a 10% improvement over the initial 20% savings prediction. Included within these subcontractor figures are a number of assemblies which were originally designated as in-house make items. However, the increased quantities engendered by the aggressive multi-year aspect of the program fostered a revisitation of the make-buy profile and resulted in a number of items being redesignated to the "buy" category due to limitations in capacity. This action resulted in additional competitions and further reduced the unit cost of each C-2A aircraft.

#### MULTI-YEAR SAVINGS — C-2A DATA FIRM CONTRACTS IN FORCE

	ANNUAL YR	MULTI-YEAR	SAVINGS \$M	%
ELECTRO-MECHANICAL SYSTEMS	\$17.0M	\$12.1M	\$8.7M	32
MECHANICAL SYSTEMS	\$63.2M	\$30.0M	\$14.6M	27
ELECTRONICS	\$12.0M	\$7.7M	\$4.0M	30
TOTALS	\$93.0M	\$50.0	\$23.0M	30

Figure 6

#### CONCLUSIONS/SUMMARY

Teamwork, as demonstrated by Congressional actions to alter the laws, DOD's management and policy initiatives, the services requirements and funding planning and contractors and subcontractors productivity and risk assumption efforts has yielded better than expected results in the application of the Multi-Year Procurement Initiative. Government, while recognizing that multi-year does not fit all programs, is realizing better than projected savings on the programs that have been selected for multi-year. Industry has found that an aggressive multi-year approach can stabilize employment, aid in their modernization programs and increase the efficiency of their existing operations. Everyone has found that the rewards have far exceeded the risks and it remains for Congress to determine whether it can overcome its penchant for year to year adjustments and take a long term view of defense procurement so that the scope of the multi-year application can grow beyond its present foothold. Meanwhile, Multi-Year Procurement, the 1980's version, is providing all the expected benefits by driving unit costs down, while improving our defense industrial base and putting people back to work, truly an initiative for our times.